

***Amendments to the Claims***

The listing of claims will replace all prior versions, and listings of claims in the application.

1. *(Currently Amended)* A method of preparing a user recommendation comprising:

generating, in memory, a sparse unary ratings matrix from ~~a user's~~ users' selected preferences, wherein said each user's selected preferences are represented as unary data entries in said sparse unary ratings matrix, wherein each unary data entry has a value of either zero or one;

forming in at least one data processing device a plurality of data structures representing said sparse unary ratings matrix, wherein the plurality of data structures includes a matrix of co-rates, and wherein the matrix of co-rates includes either a pre-multiplication of the sparse unary ratings matrix by a transpose of the sparse unary ratings matrix or a post-multiplication of the sparse unary ratings matrix by the transpose of the sparse unary ratings matrix;

forming in the at least one data processing device a runtime recommendation model from said plurality of data structures;

determining in the at least one data processing device a recommendation from said runtime recommendation model in response to a request for a recommendation; and

providing said recommendation in response to said request.

2. *(Original)* The method of claim 1 further comprising calculating a unary multiplicity voting recommendation from said runtime recommendation model.

3. *(Original)* The method claim 1 further comprising calculating a non-unary multiplicity voting recommendation from said runtime recommendation model.

4. *(Previously Presented)* The method of claim 2 wherein said calculating a unary multiplicity voting recommendation comprises calculating an anonymous recommendation.

5. *(Previously Presented)* The method of claim 2 wherein said calculating a unary multiplicity voting recommendation comprises calculating a personalized recommendation.

6. *(Previously Presented)* The method of claim 3 wherein said calculating a non-unary multiplicity voting recommendation comprises calculating an anonymous recommendation.

7. *(Previously Presented)* The method of claim 3 wherein said calculating a non-unary multiplicity voting recommendation comprises calculating a personalized recommendation.

8. *(Previously Presented)* The method of claim 1,

wherein said forming a runtime recommendation model from said plurality of data structures comprises:

mapping said sparse unary ratings matrix into a plurality of sub-space ratings matrices, said mapping comprising multiplying said unary ratings

matrices by a mappings matrix between said unary ratings matrices and a plurality of categories, and wherein each of said sub-space ratings matrices corresponds to one of said plurality of categories.

9. *(Withdrawn)* A method of preparing a recommendation to be accessed by a user comprising the steps of:

- providing a sparse ratings matrix;
- banding said sparse ratings matrix;
- distributing said banded sparse ratings matrix to a plurality of computing nodes, wherein each of said computing nodes generates an output;
- forming a runtime recommendation model from said output of said plurality of computing nodes;
- determining a recommendation from said runtime recommendation model in response to a request from a user; and
- providing said recommendation to said user.

10. *(Withdrawn)* A method of preparing a recommendation to be accessed by a user comprising the steps of:

- providing a sparse ratings matrix;
- striping said sparse ratings matrix;
- distributing said striped sparse ratings matrix to a plurality of computing nodes, wherein each of said computing nodes generates an output;

forming a runtime recommendation model from said output of said plurality of computing nodes;

forming a runtime recommendation model from said plurality of sub-space ratings matrix;

determining a recommendation from said runtime recommendation model in response to a request from a user; and

providing said recommendation to said user.

11. *(Currently Amended)* A method of preparing a user recommendation comprising:

generating, in memory, a sparse unary ratings matrix including ratings data represented as unary data entries, wherein each unary data entry has a value of either zero or one;

providing in a recommendation system including at least one data processing device an update ratings data structure;

forming at the at least one data processing device a plurality of data structures representing said sparse unary ratings matrix, wherein the plurality of data structures includes a matrix of co-rates, and wherein the matrix of co-rates includes either a pre-multiplication of the sparse unary ratings matrix by a transpose of the sparse unary ratings matrix or a post-multiplication of the sparse unary ratings matrix by the transpose of the sparse unary ratings matrix;

forming in the at least one data processing device a runtime recommendation model from said plurality of data structures and said update ratings data structure;

determining at the recommendation system a recommendation from said runtime recommendation model in response to a request for a recommendation;  
and  
providing said recommendation in response to said request.

12. *(Original)* The method of claim 11 further comprising calculating a unary multiplicity voting recommendation from said runtime recommendation model.

13. *(Original)* The method of claim 11 further comprising calculating a non-unary multiplicity voting recommendation from said runtime recommendation model.

14. *(Previously Presented)* The method of claim 12 wherein said calculating a unary multiplicity voting recommendation comprises calculating an anonymous recommendation.

15. *(Previously Presented)* The method of claim 12 wherein said calculating a unary multiplicity voting recommendation comprises calculating a personalized recommendation.

16. *(Previously Presented)* The method of claim 13 wherein said calculating a non-unary multiplicity voting recommendation comprises calculating an anonymous recommendation.

17. *(Previously Presented)* The method of claim 13 wherein said calculating a non-unary multiplicity voting recommendation comprises calculating a personalized recommendation.

18. *(Previously Presented)* The method of claim 11, further comprising:

mapping said sparse unary ratings matrix into a plurality of sub-space ratings matrices, said mapping comprising multiplying said unary ratings matrices by a mapping matrix between said unary ratings matrices and a plurality of categories, and each of said sub-space ratings matrices corresponding to one of said plurality of categories.

19. *(Withdrawn)* The method of claim 1, wherein forming a runtime recommendation model from a plurality of data structures, comprises:

forming a first recommendation model from said plurality of data structures; and

perturbing said first recommendation model to generate a runtime recommendation model.

20-26. *(Canceled)*.

27. *(Withdrawn)* The method of claim 1, wherein forming a runtime recommendation model from a plurality of data structures, comprises:

forming a first recommendation model from said plurality of data structures;

truncating said first recommendation model to generate a runtime recommendation model.

28 - 34. *(Canceled)*.

35. (*Withdrawn*) A method of preparing a recommendation to be accessed by a user comprising the steps of:

- providing a first ratings matrix;
- providing a second ratings matrix;
- forming a runtime recommendation model from a cross-set of co-occurrences of said first ratings matrix and said second ratings matrix;
- calculating a recommendation from said runtime recommendation model in response to a request from a user; and
- providing said recommendation to said user.

36. (*Currently Amended*) A method of preparing a user recommendation, comprising:

- receiving at a first recommendation system, including a data processing device, a runtime recommendation model from a second recommendation system, wherein the runtime model is formed from a plurality of data structures representing a unary array of ratings entries that can be arithmetically manipulated, wherein each unary data entry has a value of either zero or one, and wherein a majority of the entries in the array are zero, wherein the plurality of data structures includes a matrix of co-rates, and wherein the matrix of co-rates includes either a pre-multiplication of the sparse unary ratings matrix by a transpose of the sparse unary ratings matrix or a post-multiplication of the sparse unary ratings matrix by the transpose of the sparse unary ratings matrix;
- receiving at the first recommendation system a request for a recommendation;

generating in the data processing device of the first recommendation system a recommendation using the received runtime recommendation model; and transmitting the recommendation.

37. *(Previously Presented)* The method of claim 36, wherein said generating a recommendation comprises:

calculating a unary multiplicity voting recommendation from the received runtime recommendation model; and generating an anonymous recommendation.

38. *(Previously Presented)* The method of claim 36, wherein said generating a recommendation comprises:

calculating a unary multiplicity voting recommendation from the received runtime recommendation model; and generating a personalized recommendation.

39. *(Previously Presented)* The method of claim 36, wherein said generating a recommendation comprises:

calculating a non-unary multiplicity voting recommendation from the received runtime recommendation model; and generating an anonymous recommendation.



40. (*Previously Presented*) The method of claim 36, wherein said generating a recommendation comprises:

calculating a non-unary multiplicity voting recommendation from the received runtime recommendation model; and  
generating a personalized recommendation.

41. (*Currently Amended*) A method for generating a runtime recommendation model comprising:

retrieving at a first recommendation system, including a data processing device, a unary array of ratings entries that can be arithmetically manipulated, wherein data in the unary array of ratings entries is unary data, wherein each unary data entry has a value of either zero or one, and wherein a majority of the entries in the array are zero;

receiving at the first recommendation system an update to the unary array of ratings entries;

generating in the data processing device of the first recommendation system the runtime recommendation model from a plurality of data structures representing the unary array of ratings entries, wherein the plurality of data structures includes a matrix of co-rates, and wherein the matrix of co-rates includes either a pre-multiplication of the sparse unary ratings matrix by a transpose of the sparse unary ratings matrix or a post-multiplication of the sparse unary ratings matrix by the transpose of the sparse unary ratings matrix; and

providing the runtime recommendation model from the first recommendation system to a second recommendation system, wherein the second recommendation system generates a recommendation using the runtime recommendation model.

42. *(Currently Amended)* A data processing device, comprising:

a processor configured to generate in memory a sparse unary ratings matrix from ~~a user's~~susers' selected preferences, wherein ~~said~~each user's selected preferences are represented as unary data entries in said sparse unary ratings matrix, wherein each unary data entry has a value of either zero or one;

wherein the processor is configured to form a plurality of data structures representing said sparse unary ratings matrix, wherein the plurality of data structures includes a matrix of co-rates, and wherein the matrix of co-rates includes either a pre-multiplication of the sparse unary ratings matrix by a transpose of the sparse unary ratings matrix or a post-multiplication of the sparse unary ratings matrix by the transpose of the sparse unary ratings matrix;

wherein the processor is configured to store said plurality of data structures in the memory;

wherein the processor is configured to form a runtime recommendation model from said plurality of data structures; and

wherein the processor is configured to determine a recommendation from said runtime recommendation model in response to a request for a recommendation.

43. *(Currently Amended)* A data processing device comprising:

means for generating in memory a sparse unary ratings matrix from users'  
~~a user's~~ selected preferences, wherein ~~said~~each user's selected preferences are  
represented as unary data entries in said sparse unary ratings matrix, wherein  
each unary data entry has a value of either zero or one, and wherein a majority of  
the entries in said sparse unary ratings matrix are zero;

means for forming a plurality of data structures representing said sparse  
unary ratings matrix, wherein the plurality of data structures includes a matrix of  
co-rates, and wherein the matrix of co-rates includes either a pre-multiplication of  
the sparse unary ratings matrix by a transpose of the sparse unary ratings matrix  
or a post-multiplication of the sparse unary ratings matrix by the transpose of the  
sparse unary ratings matrix;

means for storing said plurality of data structures in the memory;

means for forming a runtime recommendation model from said plurality  
of data structures; and

means for determining a recommendation from said runtime  
recommendation model in response to a request for a recommendation.

44. *(Currently Amended)* An article of manufacture including a computer-  
readable storage medium having stored ~~therein~~thereon computer-executable instructions  
~~that, if executed~~execution of which by a processing device, ~~cause~~causes the processing  
device to perform ~~a method~~operations comprising:

generating in memory a sparse unary ratings matrix from ~~a user's~~users'  
selected preferences, wherein ~~said~~each user's selected preferences are represented

as unary data entries in said sparse unary ratings matrix, wherein each unary data entry has a value of either zero or one;

forming a plurality of data structures representing said sparse unary ratings matrix, wherein the plurality of data structures includes a matrix of co-rates, and wherein the matrix of co-rates includes either a pre-multiplication of the sparse unary ratings matrix by a transpose of the sparse unary ratings matrix or a post-multiplication of the sparse unary ratings matrix by the transpose of the sparse unary ratings matrix;

forming a runtime recommendation model from said plurality of data structures; and

determining a recommendation from said runtime recommendation model in response to a request for a recommendation.

45. *(New)* The method of claim 1, wherein the matrix of co-rates is an item-item matrix of co-rates.

46. *(New)* The method of claim 1, wherein the matrix of co-rates is a client-client matrix of co-rates.

47. *(New)* A method of preparing a user recommendation comprising:

generating, in memory, a sparse unary ratings matrix from users' selected preferences;

forming in at least one data processing device a plurality of data structures representing said sparse unary ratings matrix, wherein the plurality of data structures includes a matrix of co-rates, and wherein the matrix of co-rates

includes either a pre-multiplication of the sparse unary ratings matrix by a transpose of the sparse unary ratings matrix or a post-multiplication of the sparse unary ratings matrix by the transpose of the sparse unary ratings matrix;

forming in the at least one data processing device a runtime recommendation model from said plurality of data structures;

determining in the at least one data processing device a recommendation from said runtime recommendation model in response to a request for a recommendation; and

providing the recommendation in response to the request.

48. (New) The method of claim 47, wherein said forming a runtime recommendation model includes using a formulation:

$$\text{Unary\_Multi\_Vote}(i,j)_{k'}(R_u, *, k) = \text{TOP}_{k'}(z \in R_u, * \sum_{(1-1)} \mathbf{M}(i,j)^{r(k)}_{z,*}), \text{ and}$$

wherein  $\text{TOP}_{k'}$  returns the top- $k'$  values of its argument,

$${}_{(1-1)}\mathbf{M} = \mathbf{R}' \mathbf{R},$$

$\mathbf{R}$  is the sparse unary ratings matrix, and

$\mathbf{R}'$  is the transpose of the sparse unary ratings matrix.

49. (New) The method of claim 1, wherein said forming a runtime recommendation model includes using a formulation:

$$\text{Unary\_Multi\_Vote}(i,j)_{k'}(R_u, *, k) = \text{TOP}_{k'}(z \in R_u, * \sum_{(1-1)} \mathbf{M}(i,j)^{r(k)}_{z,*}), \text{ and}$$

wherein  $\text{TOP}_{k'}$  returns the top- $k'$  values of its argument,

$${}_{(1-1)}\mathbf{M} = \mathbf{R}' \mathbf{R},$$

$\mathbf{R}$  is the sparse unary ratings matrix, and

$\mathbf{R}'$  is the transpose of the sparse unary ratings matrix.